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EOSDIS Core System Project

ECS Overall System Acceptance Test Plan for Release B

October 1995

Hughes Information Technology Corporation
Upper Marlboro, Maryland

ECS Overall System Acceptance Test Plan for Release B

October 1995

Prepared Under Contract NAS5-60000
CDRL Item 069

APPROVED BY

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Preface

This document presents the Release B Acceptance Test Plan (ATP) for the EOSDIS Core System (ECS). This is a formal contract deliverable with an approval code 1. It requires Government review and approval prior to acceptance and use. Changes to this document shall be made by document change notice (DCN) or by complete revision.

Once approved, this document shall be under ECS Project Configuration Control. Any questions or proposed changes should be addressed to:

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Abstract

The ECS Overall System Acceptance Test (ATP) Plan for the ECS Project describes in greater detail the Independent Acceptance Test Organization's (IATO) test plan, which was outlined in the Acceptance Testing Management Plan for the ECS Project (DID 415/VE1). It describes the ECS formal Release B tests scheduled for use at the following facilities: EOS Operations Center (EOC); System Monitoring and Coordination Center (SMC); Goddard Space Flight Center (GSFC), Marshall Space Flight Center (MSFC); Langley Research Center (LaRC); National Snow and Ice Data Center (NSIDC); Jet Propulsion Laboratory (JPL); Alaska Synthetic Aperture Radar (SAR) Facility (ASF); Oak Ridge National Laboratory (ORNL) and the EROS Data Center (EDC). The ATP specifies how the independent acceptance testing of the ECS for Release B is accomplished. It defines the plan used to formally verify that the Release B meets the specified operational, functional, performance and interface requirements. Further, the ATP ensures that the integrated system produces an operational environment for ECS operations. The ATP also serves as a guide in the development of the ECS System Acceptance Test Procedures (DID 411/VE1) document for Release B.

Keywords: AM-1, Landsat-7, IATO, scenario, sequence, test case, acceptance, ATP, AT, RIR, IDR.

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1. Introduction

1.1 Identification

This document is generated under the Earth Observing System (EOS) Data and Information System (EOSDIS) Core System (ECS), Contract NAS5-60000 approved at the ECS Office Management level. This documents is also a required deliverable under the ECS, Contract (NAS5-60000).

This Release B ECS Overall System Acceptance Test Plan (ATP) for the ECS Project describes in greater detail the Independent Acceptance Test Organization's (IATO) test plan, which was outlined in the Acceptance Testing Management Plan for the ECS Project (DID 415/VE1). The plan describes the strategy for verifying baseline requirements documented in the Verification Specification for the ECS Project, (DID 403/VE1). The ATP provides the basis for development of the ECS System Acceptance Test Procedures (DID 411/VE1) and the Release B ECS System Acceptance Test Report (DID 412/VE2).

1.2 Scope

This ATP describes how the system acceptance testing of ECS for Release B is conducted by the IATO. It describes the ECS formal Release B tests scheduled for use at the following facilities: EOS Operations Center (EOC); System Monitoring and Coordination Center (SMC); Goddard Space Flight Center (GSFC), Marshall Space Flight Center (MSFC); Langley Research Center (LaRC); National Snow and Ice Data Center (NSIDC); Jet Propulsion Laboratory (JPL); Alaska Synthetic Aperture Radar (SAR) Facility (ASF); Oak Ridge National Laboratory (ORNL) and the EROS Data Center (EDC).

This document reflects the August 23, 1995 Technical Baseline maintained by the contractor configuration control board in accordance with ECS Technical Direction No. 11 dated December 6, 1994.

1.3 Purpose and Objective

The ATP specifies how the independent acceptance testing of the ECS for Release B is accomplished. It defines the plan used to formally verify that the Release B meets the specified operational, functional, performance and interface requirements. Further, the ATP ensures that the integrated system produces a full functional environment for ECS operations. The ATP also serves as a guide in the development of the ECS System Acceptance Test Procedures (DID 411/VE1) document.

1.4 Status and Schedule

The schedule for delivery of the Acceptance Test Plan is based on the following ECS Master Schedule review milestones: System Design Review (SDR); Preliminary Design Review (PDR);

Release Initiation Reviews (RIR); and Incremental Design Reviews (IDR). Table 1-1, the Acceptance Test Plan Delivery Schedule, shows the ATP delivery schedule and content description in relationship to the ECS review milestones.

The first delivery of the Release B ATP, scheduled two weeks prior to ECS RIR, included an overview of the IATO's itinerary for test preparation and execution, a summary of the ECS Release B plus descriptions of the test scenarios. The test scenarios serve as the basis for the development of the test sequences and test cases for the testing of the Release B.

This delivery of the Release B ATP is scheduled two weeks prior to ECS Release B IDR and includes complete descriptions of the test scenarios, sequences and test cases.

Following the IDR delivery of the ATP, the ATP is updated for future ECS formal Releases. The remaining sub documents are delivered two weeks prior to each RIR and IDR.

Table 1-1. Acceptance Test Plan Delivery Schedule

ECS Release Milestones	ATP Delivery Schedule	Content Description
SDR	2 weeks prior to ECS SDR	Complete detailed descriptions of the overall acceptance test plan activities. Completed scenario descriptions to be used for Release A.
PDR	2 weeks prior to ECS PDR	Completed test scenario, sequence and test case descriptions to be used for Release A.
RIR	2 weeks prior to Release B RIR	Complete detailed descriptions of the test plan activities. Completed scenario descriptions to be used for Release B.
IDR	2 weeks prior to Release B IDR	Completed test scenarios, sequence and test case descriptions for Release B.

1.5 Document Organization

This ATP describes the tests used in the conduct of the Acceptance Test (AT) to ensure that the EOSDIS Core System software meets the functional and performance requirements scheduled for Release B.

This document is composed of twelve sections, an acronym list and glossary.

Section 1 Introduction, describes the scope, purpose, objectives, schedule, and organization of the ATP.

Section 2 Related Documentation, lists documents related to this ATP and the nature of their relationship.

Section 3 Test Plan Overview, defines and describes the ECS AT test philosophy, test characteristics and scope of test scenarios.

Section 4 System Acceptance Test Criteria, presents the IATO's judgment of what criteria each ECS release must meet in order to be acceptable to the Government.

Section 5 Test Responsibilities, outlines the roles and responsibilities of organizations supporting acceptance testing.

Section 6 Resource Requirements, defines acceptance testing in terms of data, facilities and test tools.

Section 7 Release B Acceptance Test Overview, provides a summary of the Release B capabilities.

Section 8 System Management Scenario Group, specifies the AT plans that demonstrate ECS readiness to perform system and site management functions.

Section 9 Push Scenario Group, specifies AT plans for evaluating ECS ingest and preprocessing procedures.

Section 10 Pull Scenario Group, specifies AT plans for evaluating ECS services necessary to search, access and retrieve Release B data holdings at each site.

Section 11 Flight Operations Scenario Group, specifies AT plans for evaluating Release B functions that apply to EOS AM-1 flight operations.

Section 12 End-to End Scenario Group, specifies AT plans for evaluating ECS capabilities for supporting inter-site communications, end-to-end mission support, science data handling and processing and system performance.

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2. Related Documentation

2.1 Parent Documents

The following documents are the parents from which the scope and content of this document derives:

107-CD-001-007	Level 1 Master Schedule for the ECS Project
209-CD-001-001	Interface Control Document Between EOSDIS Core System (ECS) and the NASA Science Internet (NSI) for the ECS Project
209-CD-005-003	Interface Control Document Between EOSDIS Core System (ECS) and the Science Computing Facilities (SCF) for the ECS Project
209-CD-006-003	Interface Control Document Between EOSDIS Core System (ECS) and the National Oceanic and Atmospheric Administration (NOAA) Affiliated Data Center (ADC) for the ECS Project
209-CD-007-002	Interface Control Document Between EOSDIS Core System (ECS) and TRMM Science Data and Information System (TSDIS) for the ECS Project
209-CD-002-02	Interface Control Document Between EOSDIS Core System (ECS) and ASTER Ground Data Systems
194-219-SE1-001	Interface Requirements Document Between EOSDIS Core System (ECS) and the NASA Science Internet (NSI)
194-219-SE1-004	Interface Requirements Document Between EOSDIS Core System (ECS) and the Version 0 (V0) System
193-219-SE1-008	Interface Requirements Document Between EOSDIS Core System (ECS) and Program Support Communications Network, Draft
194-219-SE1-018	Interface Requirements Document Between EOSDIS Core System (ECS) and Tropical Rainfall Measuring Mission (TRMM) Ground System for the ECS Project
305-CD-014-001	Release A GSFC DAAC Design Specification for the ECS Project
305-CD-015-001	Release A LaRC DAAC Design Specification for the ECS Project
305-CD-016-001	Release A MSFC DAAC Design Specification for the ECS Project
194-401-VE1-002	Verification Plan for the ECS Project
194-403-VE1-002	Verification Specification for the ECS Project

194-415-VE1-002	Acceptance Testing Management Plan for the ECS Project
404-CD-001-002	Procedure for Control of Unscheduled Activities During Verification for the ECS Project
423-41-01	Goddard Space Flight Center, EOSDIS Core System (ECS) Statement of Work
423-41-02	Goddard Space Flight Center, Functional and Performance Requirements Specification for the Earth Observing System Data and Information System (EOSDIS) Core System (ECS)
505-41-12	Goddard Space Flight Center, Interface Requirements Document between EOSDIS Core System (ECS) and Science Computing Facilities
505-41-13	Goddard Space Flight Center, Interface Requirements Document Between EOSDIS Core System (ECS) and the Landsat 7 System
505-41-15	Goddard Space Flight Center, Interface Requirements Document Between EOSDIS Core System (ECS) and Earth Observing System (EOS) AM-1 Flight Operations
505-41-18	Goddard Space Flight Center, Interface Requirements Document between Earth Observing System Data and Information System (EOCSIDS) and MITI ASTER GDS Project
505-41-19	Goddard Space Flight Center, Interface Requirements Document Between the EOSDIS Core System (ECS) and the National Oceanic and Atmospheric Administration (NOAA) Affiliated Data Center (ADC)
505-41-21	Goddard Space Flight Center, Interface Requirements Document between EOSDIS Core System (ECS) and NASA Institutional Support Systems (NISS)
560-EDOS-0211.0001	Interface Requirements Document (IRD) Between the Earth Observing System (EOS), Data and Operations System (EDOS), and the EOS Ground System (EGS) Elements

2.2 Applicable Documents

The following documents are directly applicable to this plan.

604-CD-001-004	Operations Concept for the ECS Project: Part 1-- ECS Overview
604-CD-002-002	Operations Concept for the ECS project: Part 2B -- ECS Release B, Annotated Outline

2.3 Information Documents

The following documents, although not directly applicable, amplify or clarify the information presented in this document, but are not binding:

210-TP-001-004	Technical Baseline for the ECS Project
222-TP-003-006	Release Plan Content Description for the ECS Project
none	Goddard Space Flight Center, EOSDIS Backbone Network (EBnet) Interface Requirements Document, Draft
none	EOSDIS Integration and Certification Presentation
none	NASA, EOS Reference Handbook

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3. Test Plan Overview

3.1 Acceptance Testing Approach

Test scenarios are the driving mechanism for the overall approach of the IATO to evaluate ECS software and hardware. Acceptance testing addresses the broadest scope of requirements, while lower levels of verification address requirements that satisfy functions fully contained within builds that make up releases. The acceptance testing objective is to verify that the end-to-end ECS operations satisfy ECS requirements in the following categories:

Operational Requirements: ensure that the ECS operates in accordance with forward and return link data, flight operations, data capture, data archive, and data distribution requirements, thereby verifying full end-to-end capabilities of the ECS.

Functional Requirements: ensure that the required tasks are accomplished and that the needs and objectives of users are met.

Performance Requirements: ensure that performance objectives with respect to throughput, delay, number of simultaneous transactions in progress are satisfied. Requirements include speed, accuracy, frequency, reliability, maintainability, and availability.

Interface Requirements: ensure that external and internal systems pass information or control to one another in accordance with specifications.

Requirements are mapped to test cases, which are defined in this ATP. The requirements and the test cases through which they are verified are tracked and maintained through the Requirements & Traceability Management (RTM) Computer Aided Software Engineering (CASE) tool and later published in the Verification Specification for the ECS Project (DID 403/VE1).

3.1.1 Acceptance Test Plan Structure

The construction of the acceptance test plan is based on a hierarchical approach which consists of: scenario group, scenario, sequence, and test case. Figure 3-1 is an Acceptance Test Plan hierarchy block diagram, which includes as hierarchical levels: scenario group, scenario, sequence and test cases. Calibration Parameters Receipt Sequence

Scenario Group is a collection of scenarios which form the highest level subdivision of the system for the purpose of acceptance testing. Section 7 provides an introduction which defines the groups' functional objectives and the type of scenarios that are included in the scenario group.

Scenario is a subdivision of the group which can be executed independently of any other scenario identified within that scenario group, except for the Flight Operations Segment group. Each scenario is sub-divided into two or more test sequences. Section 7 provides a high level description and a stated purpose of the scenario.

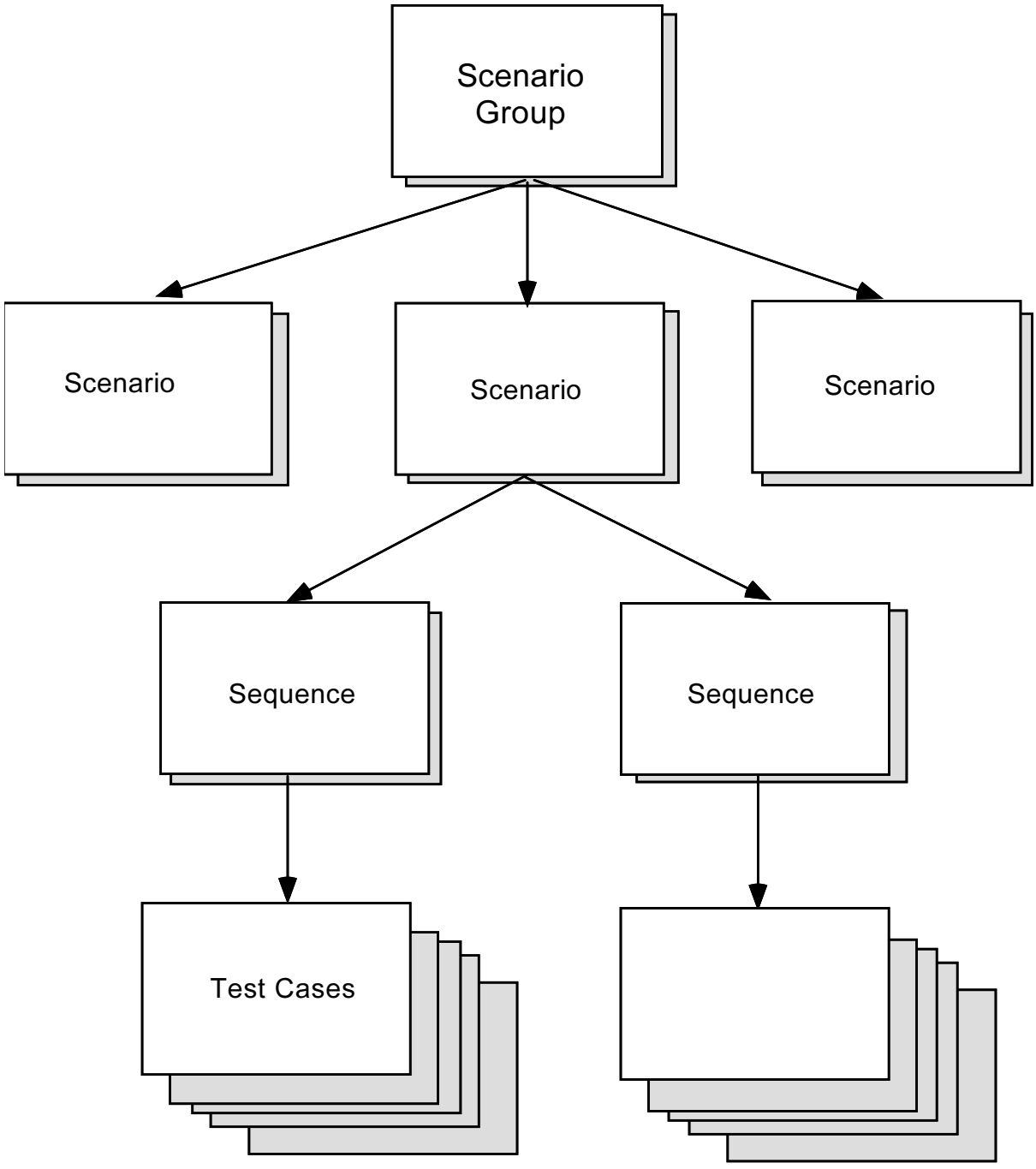

Figure 3-1. Acceptance Test Plan Hierarchy

Figure 3-1. Acceptance Test Plan Hierarchy.

Sequence is a subdivision of a scenario which is designed to verify a number of related requirements in a logical sequence. For example, operations related to data browse might be contained in one test sequence.

Test Case is a small grouping of actions that form the building blocks of the test sequence. An example of a test case might be the data ingest portion of the Data Ingest, Processing and Archive Sequence for a specific dataset. The purpose of creating test cases is two fold: first, it provides a limited area of functionality for the development of test procedures, and second, it reduces requirement verification problems created by anomalous test results or errors since each test case is short and contains only a few requirements. Since test cases are relatively short, they provide a convenient breakpoint for the Acceptance Test Team (ATT) to review the results and determine if the requirements were met. Each test case identifies the test objective, test methodology, test inputs and test expected results.

Each Test Case describes how the requirements are verified. The test case specifies the inputs (in terms of data sets, simulated interface data, etc.) needed to stimulate the system under test. The test cases also describe the outputs and expected results from the test. Comparison of the expected results to the actual outputs provide the basis for a pass/fail determination of the test.

These test cases form the basis for the development of the ECS System Acceptance Test Procedures (ATPR) (DID 411/VE1). The ATPR contains the following information required to perform the test cases: test preparation and setup procedures, describing the operating system configuration, and any special initialization instructions; identification of the input data sources and files; step-by-step procedures and detailed expected results for each step; descriptions of the acceptance test criteria; and schedules describing dependencies between particular test cases and when each test is conducted.

Generating scenarios, preparing scenario sequences, analyzing requirements, and conducting test runs are discussed in more detail in the following sections.

3.1.2 Test Scenarios

Test scenarios are developed from two viewpoints: users and operations. Both user and operations scenarios are developed to verify the requirements compliant operation of ECS components within the fully integrated ECS environment. These scenarios also verify the operation of interfaces between ECS segments (internal interfaces) and between the ECS and external entities (external interfaces). A spacecraft control telemetry data interface between command and control elements, and a user interface to a science data archive are examples of the internal and external interfaces, respectively, that are incorporated in operational and user scenarios. Scenarios are developed primarily by the science user community and the ECS contractor.

User test scenarios illustrate typical user interactions with the ECS. These scenarios are based primarily on user model scenarios obtained from the science user community via the ECS Science Office and the Maintenance and Operation (M&O) Team.

Operations test scenarios are oriented towards ECS operations and management requirements. These scenarios are developed primarily by the IATO and address various operational concepts without focusing on a specific user group. Operations test scenarios focus on such areas as spacecraft command and control, problem reporting and correcting, schedule adjudication, resource tracking, and security control.

The test scenarios provide the basic framework for ECS system-level acceptance testing. They describe a representative chain of events that entail science user and operations interactions with the ECS. They are modeled as stimulus/response patterns which form a logical sequence of operations. By using scenarios in acceptance testing, typical events that can occur during ECS operations are tested for proper system response prior to Government acceptance. Since the scenarios are mapped to their underlying requirements, in the requirements matrix documented in the ECS Verification Specification (DID 403/VE1), the requirements that are linked to a particular scenario are tested by virtue of executing the scenario. Completeness in scenario definition is confirmed in the requirements matrix, which maps Level-3 requirements to the acceptance test cases described in Sections 8 through 12. When taken together, these scenarios can be traced to the ECS Level 3 requirements. Thus, Level-3 requirements are verified during acceptance testing with assurance that the required level of testing completeness has been attained.

Scenarios are categorized into five groups. Four of the groups – System Management, Push, Pull, and Flight Operations represent ECS functionality based on operations at the functional level. The fifth group, End-to-End, is designed to test user and mission related themes at the ECS system level. The first four scenario groups were chosen to ensure complete coverage of ECS capabilities, while limiting the number of functions to selected areas, the grouping of which tends to provide more control in the initial test environment and provide for improved isolation in retesting.

ECS fundamental capabilities are characterized by the following scenario groups:

ECS System Management Scenarios: include verification of sustaining functions for engineering maintenance, routine data center operations, scheduling, resource allocation, configuration management, fault management, upgrades, contingency operations, and security.

Push Scenarios: include verification of product processing and reprocessing which includes ingesting instrument data and associated activities such as production of higher-level data, calibration, quality assurance.

Pull Scenarios: include verification of user access to the system for data acquisition, data search, selection, and access; it also involves verification of procedures for using science data.

Flight Operations Scenarios: include verification of planning, scheduling, commanding, management and operation of instruments, telemetry processing, monitoring spacecraft and instrument health and safety, resource management, data management, user interface, inter-process communication, Instrument Support Terminal (IST) tool kits, and interfaces with external systems.

End-to-End Scenarios: include verification of interactive functionality among the ECS and multiple external systems, interoperability among the Distributed Active Archive Center (DAAC) sites to perform system required operations, and end-end-mission support.

3.1.3 Test Sequences and Test Cases

A test scenario is sub-divided into two or more sequences. Individual sequences may isolate the functions that a given individual performs or may simply divide an especially long scenario into manageable pieces. Scenario sequences are sub-divided into specific test cases. Each test case describes a test objective, test methodology, test inputs, and test expected results. User guides, requirement documents, design specifications, and interface control documents are the sources for identifying inputs and output for a particular test case. The RTM tool contains the test scenario, test sequence, and test case numbers traced to requirements by release. This information is captured in the Requirements Matrix found in the ECS Verification Specification (DID 403/VE1).

3.1.4 Test Requirements Analysis

The Level-3 requirements are documented in the Functional and Performance Requirements Specification (F&PRS) for ECS (423-41-02) and Interface Requirements Documents (IRDs). The Requirements Matrix in the Verification Specification is the basis for correlating test scenarios with the Level-3 requirements by release. This matrix is maintained using the RTM tool to provide the ECS project with a central database containing a current and complete composite of the Level-3 requirements.

The method of verification for each requirement is identified and tracked by RTM. For a given requirement, multiple verification methods might be employed. The method(s) chosen is (are) determined by the nature of the requirement.

The four standard methods used to verify ECS requirements are:

Inspection. The visual, manual examination of the verification item and comparison to the applicable requirement or other compliance documentation, such as engineering drawings.

Analysis. Technical or mathematical evaluation based on calculation, interpolation, or other analytical methods. Analysis involves the processing of accumulated data obtained from other verification methods.

Demonstration. Observation of the functional operation of the verification item in a controlled environment to yield qualitative results without the use of elaborate instrumentation or special test equipment.

Test. A procedure or action taken to determine, under real or simulated conditions the capabilities, limitations, characteristics, effectiveness, reliability, or suitability of a material device, system, or method.

3.1.4.1 Requirements Verification Matrix

The requirements verification matrix also tracks the relationships between requirements and their respective releases. This matrix is updated for each formal release to reflect any changes in the system requirements.

Figure 3-2 shows a sample page of the Requirements Matrix. Fundamentally, this matrix depicts the traceability between Level-3 requirements and formal release acceptance tests, i.e., the matrix maps requirements to sequences and test cases. Specifically, the matrix contains the following items, which are shown as column headings. Each item is contained in the RTM requirements traceability CASE tool:

a. Paragraph_ID - The Level-3 requirement identifier, obtained from the Functional and Performance Requirements Specification for the ECS (423-41-02). Example: “IMS-0160”

b. Text - The text of the Requirements-by-Release requirement. Example: "ECS shall use and support the Space Network (SN), via the EDOS/Ecom interface, to obtain the forward and return link data communications needed to archive full end-to-end ECS functionality.

c. Req_category - The priority of each requirement. The options include mission critical, mission essential, mission fulfillment.

d. A_verification_method - The method by which the requirement is verified. Options are inspection, analysis, demonstration, and test.

e. System Test Number - Not applicable to acceptance testing.

f. Acceptance Test Number - The Acceptance Test codes, extracted from the Acceptance Test Class in RTM, to identify the scenarios and test cases used to verify each requirement. The format of the code includes:

   R - ATP Release identification

   GG - Scenario Group number

   ss - Scenario number

   SS - Sequence number

   .xxx - Test Case number

These items, documented in the Verification Specification and maintained by RTM, provide the traceability necessary to ensure that the ECS is tested for compliance with every requirement associated with a given release.

paragraph_ ID	Text	Req. Category	A_verif._ Method	System Test Number	Acceptance Test Number
DADS0010	Each DADS shall receive updated metadata for products that have been QA'd.	essential	test	T15-01.01.04 T15-01.02.04 T15-01.03.04 T15-01.04.04 T15-01.05.04 T15-01.09.04	B090310.050 B090320.100 B090310.100 B090320.050
DADS0020	Each DADS shall, upon receipt of updated metadata for products which have been QA'd, store the metadata in its inventory.	essential	demo	T12-02.09.00	B090310.050 B090320.100 B090310.100 B090320.050 B120530.020
DADS0100	Each DADS shall receive management directives from the SMC.	essential	test	T10-03.05.00 B10.01.00	B090530.020
DADS0145	Each DADS shall be capable of receiving from the ADCs, at a minimum, the following for the purpose of product generation: a._L0-L4 equivalent data sets b._Metadata c._Ancillary data d._Calibration data e._Correlative data f._Documents g._Algorithms	essential	test	T15-04.07.00 T15-04.07.05 T15-04.07.06 T15-04.07.07 T15-04.07.08 T15-04.07.09 T15-04.07.10	B100140.020 B120510.010 B120510.030 B120540.010 B120540.020 B090260.030 B120510.020
DADS0170	Each DADS shall be capable of receiving from designated EPDSs and ODCs, at a minimum, the following: a._L0-L4 data sets b._Metadata c._Ancillary data d._Calibration data e._Correlative data f._Documents g._Algorithms	essential	test	T10-02.01.01	B090540.010

Figure 3-2. Sample Page from Requirements Verification Matrix

3.1.5 Acceptance Test Planning

The acceptance test process involves the planning, preparation, execution and reporting on the acceptance test activities that lead up to bringing a release into the ESDIS I&T process leading to certification at the ECS sites.

Acceptance test planning is formally presented in the publication of three major documents: the Verification Plan (DID 401/VE1), the Acceptance Testing Management Plan (DID 415/VE1) and the Acceptance Test Plan (DID 409/VE1). The acceptance tests themselves are conducted in accordance with the prescriptions and expected results contained in the Acceptance Test

Procedure (ATPR) document. Both the ATP and ATPR documents reference the requirements verification matrix contained in the Verification Specification (DID 403/VE1). Contents of the Verification Specification are, in turn, imported from the requirements matrix database maintained by the RTM tool. Results of the acceptance tests are recorded in a release Acceptance Test Report (DID 412/VE1) published one month after the presentation of the Release Readiness Review (RRR).

The publication of the ATP and ATPR documents are keyed to major ECS reviews associated with each release as shown in Figure 3-3. The plan depicted in Figure 3-3 shows the availability of a Preliminary ATP for Release B coincident with the RIR presentation. It shows the availability of a Final ATP for Release B during the IDR time frame. The plan includes the publication of a Preliminary Release B ATPR document at the Test Readiness Review (TRR), with a final version of the document delivered one month prior to the Consent to Ship Review (CSR). Following the successful completion of the acceptance test phase, which begins at CSR, an Release Readiness Review (RRR) is held. The RRR presents the results of the Release B acceptance testing. The information presented at the RRR is followed-up by a written Release B Acceptance Test Report which is delivered one month later.

The Preliminary ATP delivered for RIR contained test planning information of a general nature that is applicable to the formal releases. It also contained information specific to Release B. The Preliminary ATP contains an overview of the Release B capabilities that are tested and a description of each scenario used during the acceptance test process.

The ATP delivered for IDR initiates an approach that results in new ATP documents for each release. The Release B ATP contains a complete breakdown of the testing approach used for Release B in Sections 7 through 12. The breakdown is detailed from Release B specific functions and scenarios down through sequences and test case levels.

The Release B ATPR document is delivered in two versions. A Preliminary Release B ATPR document is completed in the TRR time frame, with a final version delivered one month prior to CSR. The ATPR document is organized in site-specific volumes for each release. The Preliminary Release B ATPR document consists of a typical volume containing material of a general nature that applies to the sites, acceptance test schedules, a complete description of test tools, sample test logs, and a sample step-by-step test procedure. The Preliminary Release B ATPR document provides the Earth Science Data and Information System (ESDIS) Project Office and each site with an early view of the test procedure structure for review and comment before it is detailed in the final Release B ATPR document.

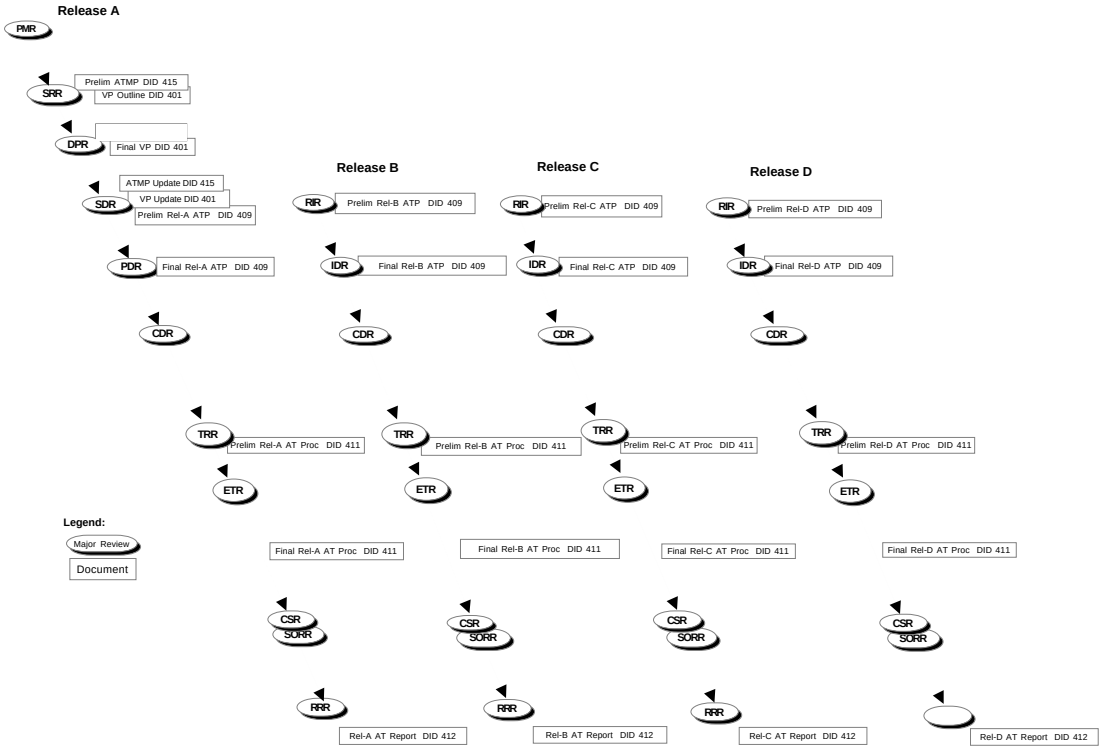

Figure 3-3. Acceptance Test Documentation Correlated to Major Review Life Cycle

The final ATPR document contains a set of site-specific volumes used to conduct acceptance testing of Release B. Each volume is complete with the following information: test preparation and setup procedures; test environment descriptions; identification of test input files; test step-by-step procedures and expected results for each step; and a description of acceptance test criteria for the test.

The same series of events occur in the preparation of ATP and ATPR documents for subsequent releases. The ATP for each release is updated and specifically tailored to verify new release capabilities.

Separate ATPR documents are published by release and is organized as separate site-specific volumes. Activities associated with Release B through Release D ATP documents are keyed to the RIRs and IDRs instead of the SDR and PDR respectively. ATPR document delivery is keyed to TRRs and CSRs.

The sequence of activities that lead up to the completion of the Release B acceptance testing is shown in Figure 3-4. It illustrates the series of acceptance test activities that take place, how they relate to the major ECS reviews, and their relationship with the documents produced. It also illustrates the activities and their relationships with the System Integration and Test (I&T), and Operations Phases of the Release B acceptance testing life cycle.

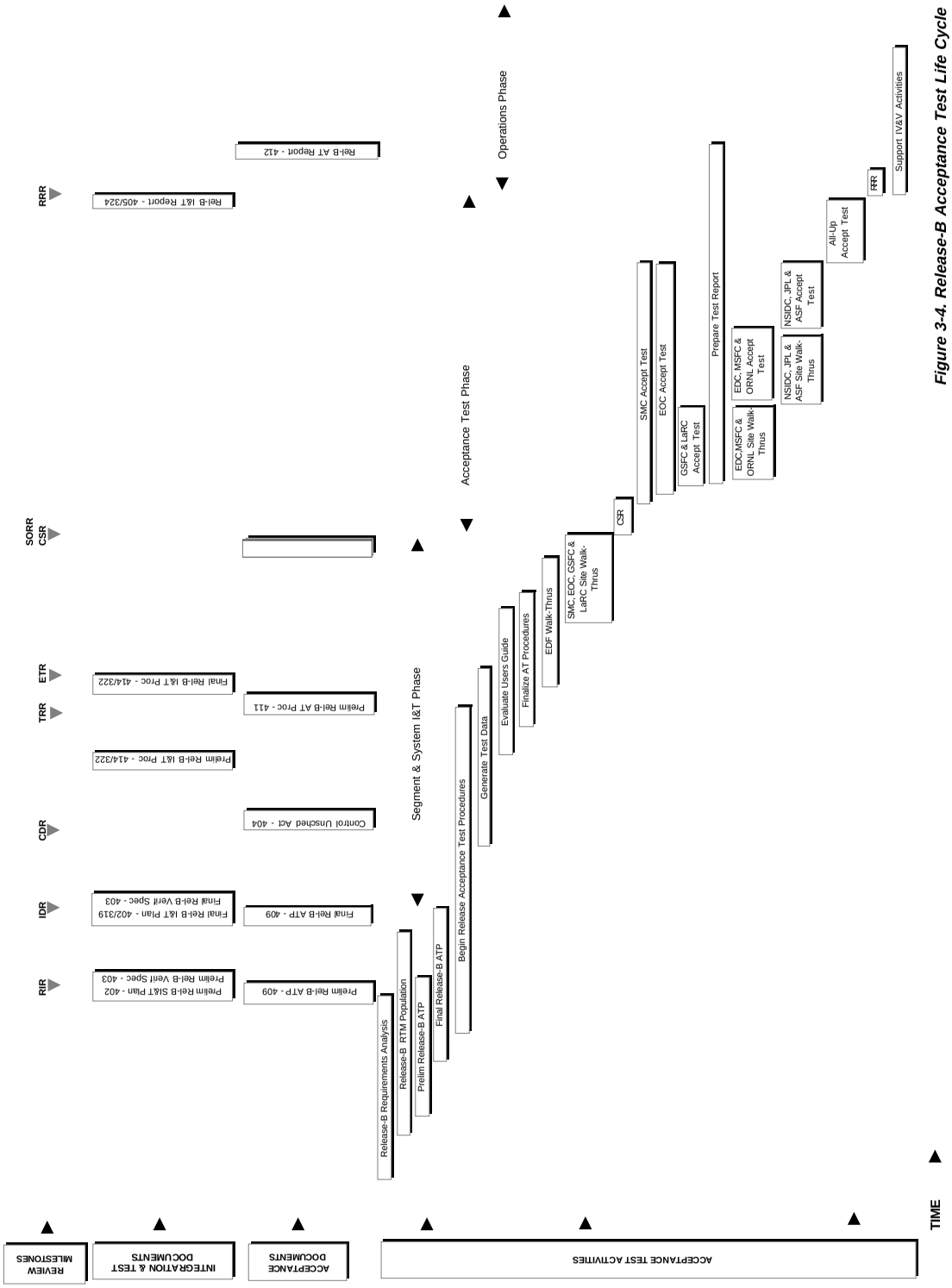

Figure 3-4. Release-B Acceptance Test Life Cycle

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3.1.6 Acceptance Test Preparation

The initial activities of acceptance test preparation are conducted at the ECS Development Facility (EDF). First, an inventory of the resources needed to perform acceptance tests is taken. Items inventoried include test input data, automated test tools, and technical documentation. If any required items are found to be missing or insufficient for acceptance test performance, corrective action is taken. Prior to CSR, additional walk-through of the entire acceptance test procedure are conducted at the EDF to ensure proper format, contents, and completeness of the test scenarios and test plan.

Additionally, prior to CSR and concurrent with the execution of integration test, critical acceptance test sequences and test cases are executed by IATO against the integration test release baseline to insure that any major problems with either the release or the acceptance test procedures and resources are found at the EDF where they can be most easily corrected. Discrepancies observed during this portion of the acceptance test preparation phase are formally filed as Non Conformance Reports (NCRs) against the integration test baseline of the system and entered into the Non conformance Reporting and Corrective Action (NRCA) system.

The Configuration Management (CM) process tracks the product changes and versions that result from correcting NCRs. After the NCRs are successfully dispositioned and integration and test acceptance criteria have been met, the system integration and test team reports on the results of their test activity at a CSR. At the completion of a successful CSR, the release is declared ready for shipment to the operational sites for installation and formal acceptance testing.

After a successful CSR is completed, a Segment Operational Readiness Review (SORR) is conducted to determine each site’s availability and readiness for acceptance testing activities. The CM office then packages the elements of the release for transfer to each site’s CM library. The Configuration Management activities related to transferring software code is described in the ECS Configuration Management Plan (DID 102/MG1) and the Configuration Management Procedures (DID 103/MG3).

The IATO performs the build of the release at each site from the materials delivered to the site's CM library. Prior to the execution of test scenarios at the test sites, three final checks are performed. The first check consists of a survey of the operational sites where the release is to be tested. This pre-test site check is to provide confidence that each operational site is properly configured for formal acceptance testing. The next pre-test check consists of performing a selected set of test cases from the previous release to ensure that existing operations at the site are not adversely affected by the installation of the new release. The final check consists of a walk-through of the entire set of acceptance test procedures to ensure site compatibility for the release. In the event that any discrepancies are observed during these three checks, the discrepancies are formally filed as NCRs in the NRCA system.

When the final checks have been successfully executed the actual execution of test scenarios is coordinated with the Site Manager by the Test Manager. A high level illustration of the acceptance test installation activities is shown in Figure 3-5, Acceptance Installation Process.

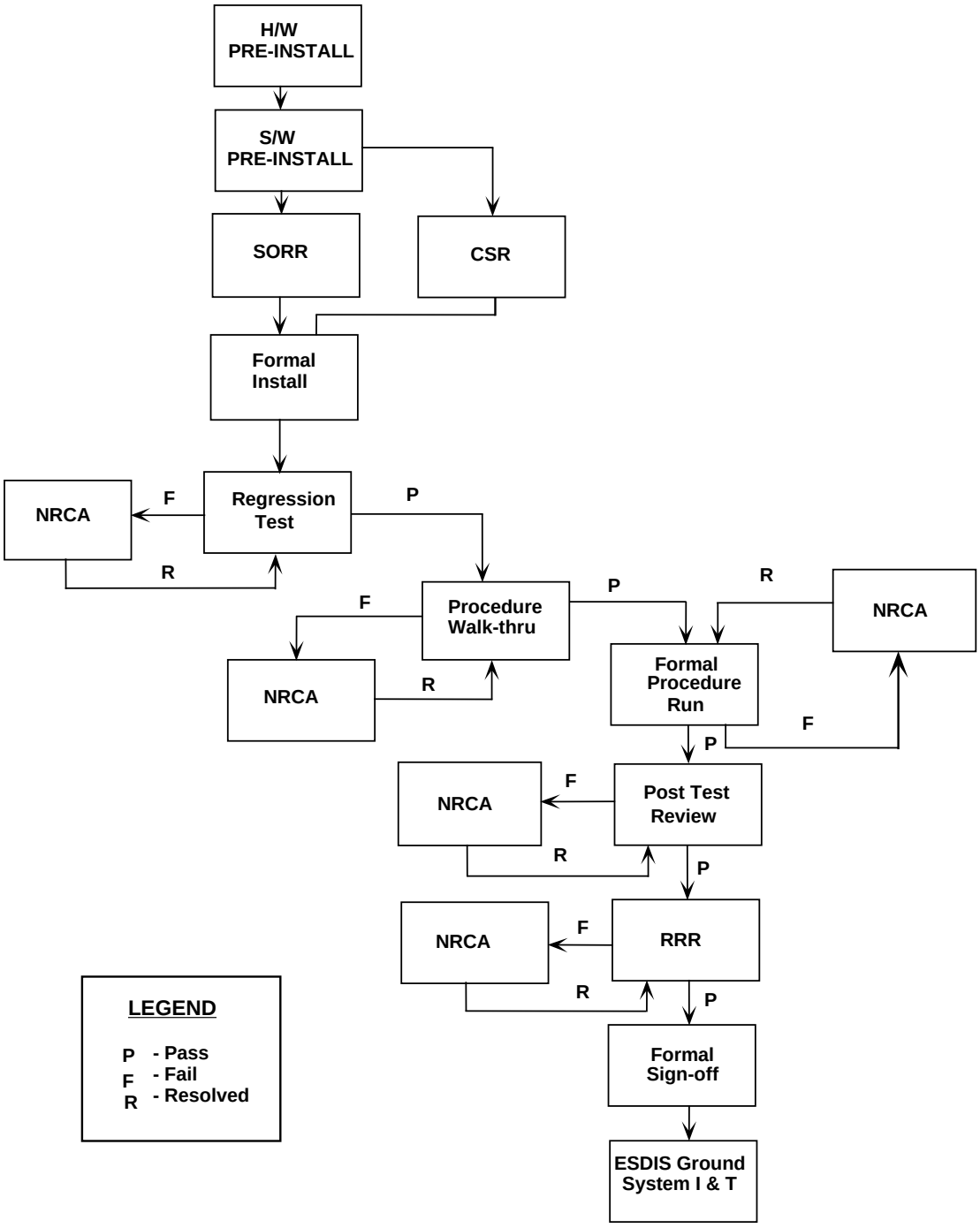

Figure 3-5. Acceptance Installation Process

3.1.7 Test Execution

Acceptance tests are conducted under the direction of an IATO Test Manager who has absolute authority regarding the execution of the acceptance test. This authority includes the assignment of priority to NCRs, NCR disposition and determination of their impact on ongoing testing. This authority is vested by the ECS Project Manager, but may be delegated by the IATO Test Manager to Test Conductors at specific times (off-shifts) and/or sites or during his absence.

For sites currently under production, the release is installed and tested by IATO in a test environment to ensure that the existing operational environment is uninterrupted during testing. Two phases of acceptance testing are executed at specified sites. These phases are: site-specific testing, where the focus is on each individual site; and "all up" testing, where the sites and elements are tested simultaneously as a system. In each case, the final scenario to be executed is an acceptance test demonstration, which exercises a comprehensive sequence of events verifying the overall site-specific and ECS-wide capabilities of the release. Formal acceptance testing is performed at the EOC, the SMC; and the Distributed Active Archive Centers (DAACs) at Goddard Space Flight Center (GSFC), Langley Research Center (LaRC), Marshall Space Flight Center (MSFC), the Earth Resources Observation System (EROS) Data Center (EDC), the Oak Ridge National Laboratory (ORNL), the Jet Propulsion Laboratory (JPL), the National Snow and Ice Data Center (NSIDC) and the Alaska Synthetic Aperture Radar (SAR) Facility (ASF). The sites that are tested for a given release are defined by the test schedules associated with a given release in the ATP for that release. Details concerning the test environment and procedures to be followed at test sites involved in a release acceptance test are described in the ATPR document.

After the test preparation and site checks have been successfully executed, formal acceptance testing may begin. Testing for the new release commences in accordance with the site-specific approved procedures documented in the ATPR document in accordance with the schedule established with the Site Manager. These tests are carried out on a day-to-day basis until the conclusion of the acceptance tests. A typical test day is divided into four segments: test set-up, test execution, test wrap-up and a post test review.

During the test set-up segment, the basic test environment is initialized and confirmed. The test data sets, test tools, and simulators are put in place, and the system and resources made ready for commencement of testing at the next sequence in the Acceptance Test Procedure.

Test execution begins with starting the first test case delineated in the next test sequence and continuing the process on a test case-by-test case basis in accordance with the test procedure. A detailed log is kept of each test case executed and the results obtained. When there is a discrepancy between actual and expected test results, exhibits concerning the discrepancy are captured and documented in an NCR. Barring the occurrence of any discrepancy that may dictate halting the test, the testing continues until its scheduled completion.

Upon completion of testing, the system is saved and secured for orderly resumption of tests on the following day.

At the completion of each day of testing, a post-test review meeting is held to review the events of the day. If acceptance testing involves simultaneous activities at multiple sites, as in the all-up acceptance test, this post-test review meeting is held in a teleconference mode. During this meeting, overall testing status is assessed. The status of previous NCRs filed is reviewed and categorized. NCRs are grouped into those open, fixed (but not tested), closed, withdrawn, and elevated to Configuration Change Request (CCR) status. Problems encountered during the day are reviewed, and actions for resolution determined. The NCRs recorded during the day are analyzed, classified for severity and given a priority for corrective action. NCRs are filed in the NRCA system for corrective action to be taken by the responsible developing segment. A daily log of statistics is kept citing the number of test cases executed, number of NCRs filed, their classification and other test metrics for status reporting purposes.

If, during the daily post test review meeting, it is determined that an NCR documents an instance that impedes further testing, acceptance testing may be halted and at the discretion of the Test Manager, the test version is returned to the responsible development organization.

As acceptance testing continues, the severity and number of unresolved NCRs are monitored on a daily basis, and compared with the established acceptance test criteria. As circumstances dictate, it may be necessary to halt testing based on the number and severity of open NCRs and resume testing when they have been corrected and incorporated in a new test version. The new test version is released by CM after it tracks the product changes and revisions that result from correcting non conformance's and returns the revised version to the test site. The acceptance test conductor then retests the new version using the scenarios that uncovered the original discrepancy to determine if the non conformance was corrected and that the system provides the expected test results.

In addition, retesting is conducted to make sure that the fix has not adversely affected other functions previously tested. The correction of NCRs that document an operator inconvenience and have no real impact on actual system operations may be deferred to follow-on formal releases.

As the acceptance testing proceeds from site to site, discrepancies may be uncovered which were not observed during tests at previous sites. If the mitigation of these discrepancies requires the generation of a new release version, retesting of the new version at each site is the first order of business during the all-up ECS acceptance test. Additional information on testing during verification is found in the Procedures for Control of Unscheduled Activities During Verification (DID 404-CD-001-001).

After testing is complete, the IATO leads the Release Readiness Review (RRR) and reports on the results of the Release Acceptance Test. The results presented in the RRR provides the basis by which the Government Acceptance Test Team (GATT) and the Contracting Officer's Technical Representative (COTR) determines if the release is ready for incorporation into the operational system. The ECS System Acceptance Test Report (DID 412/VE2) and the Acceptance Data Package (DID 535/PA1) are delivered to the GATT four weeks after RRR to provide detailed test results, their analysis and a summary of open items to be corrected in the next version.

4. System Acceptance Test Criteria

Determination of the components of an acceptable release is a process that requires joint agreement between the contractor, the GATT and the COTR. This section presents the IATO's judgment of what criteria each ECS release must meet in order to be acceptable to the Government. The IATO believes that ECS must be held to a high standard in order to meet the diverse needs of the intended user community, while at the same time realizing that the timely delivery of the system is important. The criteria outlined in this section are intended to ensure that the Government receives a high quality product.

4.1 Requirements Verification

Level 3 Requirements verification through the use of operational scenarios, is the key element in the IATO's acceptance testing program. The Level 3 requirements are documented in the F&PRS and IRDs. For level 3 requirements, each ECS release must meet the requirements applicable to that release, plus it must be demonstrated (through retesting) that requirements fulfilled during previous releases have not been invalidated by the addition of the new system release. Requirements are validated through execution of the scenarios described in this ATP, and implemented in the ATPR.

The IATO is involved in overseeing segment and system level tests and in reviewing and evaluating the results and thoroughness of these tests. The IATO confirms that the level 4 requirements have been tested and results documented by the segment level testing. Particular attention is given to verification that the mission specific Flight Operations level 4 requirements have been successfully tested. The process of confirmation involves selective review of test plans, test results and test script documentation.

Documentation related to operation of the system (i.e., Users Manuals, Operators Manuals, etc.) is a part of acceptance testing. Documents are analyzed to determine that they are complete, accurate and detailed. Any document deficiencies are noted for correction. However, document errors, in that they do not cause any serious threat to the operation of the system, are not a basis for rejection of the release.

4.2 Special Case Acceptance Testing

This section discusses the approach to perform acceptance testing to verify two special types of requirements - those involving system faults or error handling conditions and those involving 'expandability' and 'evolutionary' type requirements. Sections 4.2.1 and 4.2.2 discuss each of these cases, respectively.

4.2.1 Verifying and Accepting Error Handling Type Requirements

System acceptance testing verifies the functionality and error handling conditions in cases where there are site-specific modifications to software and hardware. These site-specific tests are documented in the ATPR for the applicable site.

System-level acceptance testing does not verify that all possible fault conditions, error conditions, or incorrect system inputs are properly handled by the system. System acceptance testing reviews, evaluates and builds upon lower level element, segment and system level testing of these special cases, and assures that there are no changes in environment which would result in different system handling of such conditions.

As examples, consider two types of requirements to be verified: 1) a user request for access to stored data; and 2) a system detection of a hardware fault, subsequent system fault handling and automated system failover to a replacement capability.

In the first case, system acceptance testing need not verify and re-test the wide variety of user log-in errors or to verify that they are screened and properly rejected by the system. Evaluation of lower level tests, in conjunction with analysis of similarity of the environment and stability of the software code, should prove adequate for acceptance. Likewise, repeats of multiple erroneous data request operations is not feasible. System acceptance test personnel check that such comprehensive testing has been performed during lower level tests and they analyze whether any possible changes in environment resulting from testing with real equipment and interfaces, e.g., at an actual DAAC, affects the test outcome or result. In cases where different environmental factors or test conditions may affect the results, or new software has been integrated into the item under test, then re-testing is required at the system acceptance test level.

In the second case, detection of a hardware fault will likely be simulated in early tests, probably at the EDF, due to the unavailability of actual equipment. Here, acceptance test personnel need to evaluate the adequacy of the hardware fault emulation, the comparability of the system error signal detection, and the types of software processing performed during lower level tests. Some special case hardware fault situations may need to be generated to confirm fault detection and fault handling capabilities, but an extensive re-test of fault detection and fault handling capabilities cannot be feasibly re-tested at the system acceptance level.

System acceptance test criteria for these situations may not be relevant for most cases since the verification of the requirement(s) are based primarily on analysis and a preset 'number' is not meaningful. In cases where testing is required, the criteria for this type of requirement is not especially different from many others. This is also the case for 'evolutionary' type of requirements, as discussed in the next subsection.

4.2.2 Verifying System Growth Requirements

A number of ECS requirements state that the system must accommodate new technologies, be capable of expansion and be upgradeable. In most cases these types of requirements are verified by analysis, e.g., by showing that the system, segment, element, etc. can accommodate the growth anticipated, evolve gracefully as technology or standards mature, and is capable of

expansion without disruption to existing capabilities or design. In some cases, simulation or results using prototypes may be needed to ensure that the requirement is satisfied.

The acceptance criterion in this case is normally a binary situation, e.g., yes or no. Alternatively, by analysis, the test personnel determines the feasible growth or capacity limit and compares it to the required parameters. In cases where it is not feasible to project the system's performance or accommodation capability, evaluation of comparable existing systems are adequate, or in some cases, the requirement may just not be verifiable at the time of the test. In this latter case, a process and time frame by which the requirement can be verified is established by the Acceptance Test Team.

4.3 Determination of Acceptability

Final determination of the acceptability of a release is made by the COTR, based on the recommendation of the GATT. The IATO participates in the RRR which takes place after testing at the DAACs has been completed. At the RRR, the IATO presents the results of the testing.

After the results of the acceptance test effort are analyzed and NCRs have been prepared, each ECS release is evaluated against acceptance criteria to provide the GATT with a recommendation on the acceptability of the release. Release acceptance is based on the system's ability to operate properly in the operational environment. NCR's provides a measure of the number and severity of discrepancies in the system. Three levels of discrepancies are used, as shown in Table 4-1.

Table 4-1. Discrepancy Classification and Priority

Classification	Description
Level 1	Critical. A discrepancy which prevents the accomplishment of an operational or mission critical capability specified requirement.
Level 2	Urgent. A discrepancy which adversely effects the accomplishment of an operational or mission essential capability specified requirement so as to degrade performance and for which an alternative work-around solution is known.
Level 3	Routine. A discrepancy which is an operator inconvenience and does not effect a required operation.

Recognizing that a zero defect system is unrealistic, the IATO proposes to use a system employed on previous GSFC projects: That the release is not accepted until the Level 1 (Critical) discrepancies have been corrected. Discrepancies classified as Urgent or Routine are reviewed at the RRR to determine if they are serious enough to prevent acceptance of the release. The focus of this review is on Urgent and Routine discrepancies that are in functionally related areas, and which taken together might prevent the accomplishment of a mission critical capability. Table 4-2 summarizes this preliminary set of acceptance criteria. It is expected that these are modified in conjunction with the GATT and the COTR.

Table 4-2. Acceptance Criteria

Classification	Number of allowable Discrepancies
Level 1 (Critical)	None.
Level 2 (Urgent)	Urgent discrepancies are reviewed at the RRR to determine if they are serious enough to prevent acceptance of the release.
Level 3 (Routine)	Routine discrepancies are reviewed at the RRR when they are related to other discrepancies which are classified as Urgent.

5. Test Responsibilities

Acceptance testing is a formal process that requires well defined roles and responsibilities for each of the participating organizations. This section provides an outline of these roles and responsibilities. They are defined (through coordination with the Government Acceptance Test Team and the ECS Quality Office) in greater detail during the development of the ATPR.

Independent Acceptance Test Organization (IATO): The IATO assigns a test manager to coordinate and run acceptance testing. The IATO also provides test conductors to execute the step-by-step procedures that are defined in the ATPR. Test conductors also write, collect, and track non conformance reports and determine the impact of these reports on test plans, scenarios, test cases, and procedures.

Quality Office (QO): The QO provides a representative to witness the execution of acceptance testing. The QO also tracks the status of non conformance reports and reviews them prior to closure to ensure that the required actions have been completed.

Configuration and Data Management Organization: The Configuration Management Office (CMO) coordinates with the IATO to capture the test configuration of software, hardware, test data, test tools, and documentation prior to test execution to ensure repeatability. They also capture and retain test outputs (e.g., test logs, data, and modified procedures) and distribute copies for test analysis. The product baseline, which is established prior to the RRR and includes test reports, is maintained by the CMO.

Government Acceptance Test Team (GATT): The GATT is responsible for independently assessing the acceptability of each ECS release. In doing so, the GATT is present, as desired, to witness acceptance testing performed by the IATO. IATO documents are reviewed by the GATT, to ensure that the IATO develops thorough acceptance test plans, procedures, and reports.

Maintenance & Operations (M&O) Organization: As part of acceptance testing at the test site, the site manager assigns M&O personnel who are integrated into the test team to help execute acceptance tests. The early first-hand involvement of the site manager and his operations personnel in site acceptance testing provides the M&O Team with early visibility into each new release and hastens a smooth transition. This involvement and familiarity with ECS software in the stages before release to the user base greatly enhance the effectiveness and productivity of the M&O staff and positions a highly competent and responsive user support staff on-site at the DAACs. In addition, during the M&O phase, the IATO assists by providing benchmark tests to verify operational performance of the ECS system. The IATO provides guidance in acceptance testing during the verification of approved changes and enhancements.

ESDIS SI&T Contractor: The ESDIS Integration Contractor and the Independent Verification and Validation (IV&V) Contractor witness and monitors acceptance testing, as directed by the ESDIS SI&T, the IV&V Contractor and the GATT.

5.1 Role Players For Testing

The Acceptance Test Team (ATT) assist various personnel during the acceptance testing phases. Listed below are the role players and a brief description of their responsibilities.

M&O Staff: Performs maintenance and operations activities, including hardware installations.

Network Analyst (NA): Performs network functions, including monitoring the network's performance and integrity.

Performance Manager (PM): Addresses system performance issues and concerns.

Resource Manager (RM): Manages ECS site resources.

System Administrator (SA): Performs overall system maintenance, including system backups and software upgrades.

Data Pull Technician: Manages ingest, pull and processing activities. (DAAC)

Production Planner: Populates and maintains the production planning database. (DAAC)

Instrument Operations Team (IOT): Executes activities performed at the CERES, MISR, MODIS, MOPITT and ASTER instrument workstations. This team consists of the IOT Engineer and IOT Scheduler.

Flight Operations Team (FOT): Executes activities performed at the EOC workstations including system initialization, scheduling, commanding and telemetry activities. This teams consists of the FOT Engineer, FOT Scheduler, FOT Command Controller and the FOT Master Controller.

Scheduler: Performs AM-1 spacecraft and instrument resource scheduling. (EOC)

Production Scheduler: Reviews, approves and activates the daily production schedule. (DAAC)

Data Ingest Technician: Oversees ingest activities including the handling of physical media (e.g., mounting tapes) from which input data are read. Responsibilities also includes verifying that all data reported on data availability schedules, product delivery notices, etc. are received, validated, accounted for, and archived. (DAAC)

Data Distribution Technician: Oversees distribution activities including handling of physical media (e.g., mounting tapes) onto which ECS data are written. (DAAC)

Science Software Integration Test Team (SSITT): Verifies that any and all updates to science software are thoroughly tested and verified before being permanently installed at the DAACs.

6. Resource Requirements

This section defines the resources required by the IATO, in order to conduct acceptance testing for each Release.

6.1 Test Tools

Automated test planning, management, and testing tools are software packages and/or databases which assist in the development and tracking of test cases, test data, requirements mapping, executing test procedures, and tracking test results. The following sections describe each of these types of tools.

6.1.1 Requirements Traceability & Management

The mapping of ECS requirements to test scenarios is done using the RTM tool. This tool has already been selected and is in use by the project. One of the outputs of this tool is contained in the Verification Specification (DID 403/VE1).

6.1.2 Automated Testing Tools

Automated Testing Tools are tools which automate the execution of test procedures/scenarios. Included in this definition are Graphic User Interface (GUI) Capture/Playback and Remote Terminal Emulators (these tools, referred to as Computer Aided Software Test (CAST) tools, are used to emulate live users), data generators (for generating simulated input data), and programmable test languages.

The ECS contractor has conducted an evaluation of COTS CAST tools and has procured (with Government approval) Mercury Interactive's XRunner and LoadRunner tools. XRunner is capable of replaying user sessions for retesting. The LoadRunner tool is specifically designed to emulate multiple simultaneous user sessions and is used to emulate the maximum numbers of users that ECS is required to support concurrently (for performance testing). The XRunner and LoadRunner tools are currently installed in the EDF.

For data generators, simulated data sets from each of the instruments are produced. For Release B this includes simulated Moderate-Resolution Imaging Spectroradiometer (MODIS), Multi-Angle Imaging Spectro-Radiometer (MISR), Clouds and the Earth's Radiant Energy System (CERES), Advanced Spaceborne Thermal Emission and Reflection (ASTER) and Measurements of Pollution in the Troposphere (MOPITT).

6.1.3 External Interface Simulators

External interfaces are interfaces to systems outside of the scope of the ECS contract (i.e., not being developed by the ECS contractor). The interfaces may be to systems already in existence, systems that are being built as a part of the overall Earth Science Data and Information System (ESDIS) project, or systems being built by other Government agencies or other countries.

Simulators for external interfaces are computer programs which transmit data in the identical format as the real system. Simulators may be very simple (i.e., send a canned message) or complex (i.e., dynamic message generation/response). For ECS, it is assumed that simulated interfaces are developed by the ECS project (with the exception of the Code 421 Ground Spacecraft (S/C) simulator and the EOSDIS Test System (ETS)).

The scenarios described in Sections 8 through 12 often identify external interfaces by their real-world names, e.g., EDOS, even though simulators, e.g., the ETS, might be utilized when verifying the interfaces. By using real-world names for interfaces and minimizing references to simulators during initial scenario development, the scenario descriptions are simplified and easier to understand. Furthermore, the means of emulating external interfaces is often not known in the early stages of developing scenarios. As more information on simulators for acceptance testing becomes known, the acceptance test procedures will identify specific simulators as needed.

6.1.4 Integration of Tools in the EDF Test Bed

Figure 6-1 shows the test tools used to exercise the system under test. For each release, external interface simulators (EOS Data and Operations System (EDOS), Affiliated Data Centers (ADC)/Other Data Centers (ODC), Internet Protocol (IP)) are developed. Data generators (or simulated data) are used to test, ingest and archive data and for data distribution.

Data reduction and analysis tools are utilities designed to analyze test output data, including utilities to compare test output to benchmark data. File compare utilities are used to compare expected to actual test results. A data reduction utility is used to reduce large amounts of output data (such as output data from the Data Processing Subsystem) to some meaningful evaluation of the data's quality.

6.1.5 Use of Test Tools During Acceptance Testing

The IATO will use data generators, HP Open view, CAST tools and interface simulators during acceptance testing. Access to tools not located at a DAAC may be accomplished through use of ECS networks. Details on specific usage of tools during acceptance testing is provided in the ATPR.

6.1.6 Use of Standard Test Data During Acceptance Testing

Since the AM-1 satellite is launched after this Release, the system is populated with a subset of the Version 0 (V0) datasets and small amounts of simulated data for AM-1 instruments and TRMM data for use during the acceptance test. The V0 data migration to ECS is planned to start during the acceptance test for Release A and continues through Release B. This provides an opportunity to run queries against datasets known to be in the ECS and V0 archives.

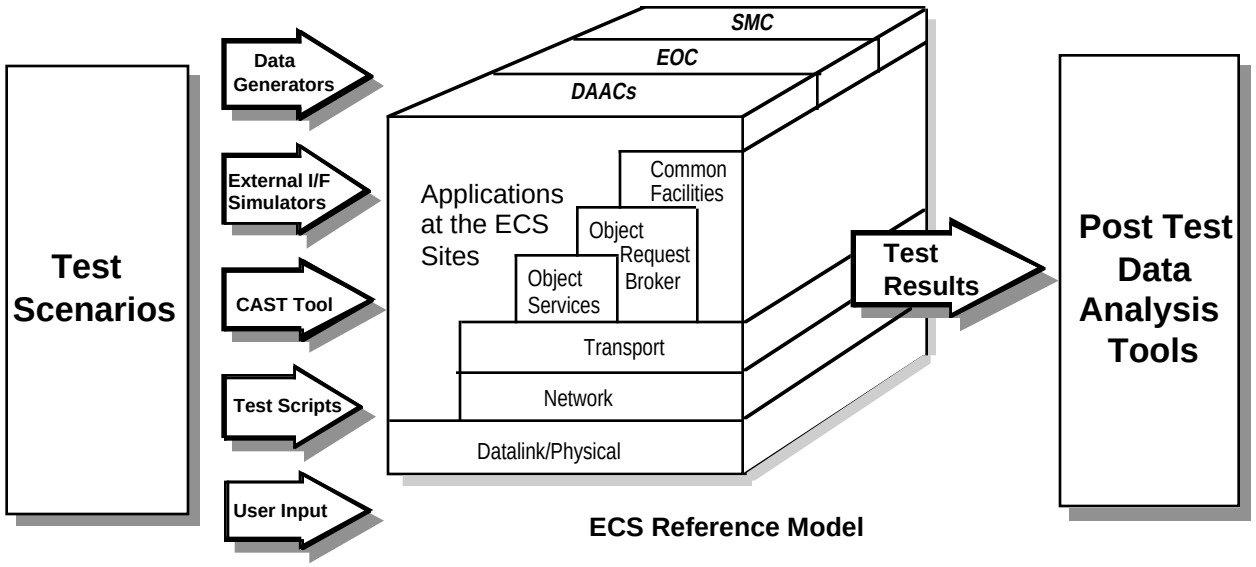

Figure 6-1. Test Tool Integration

6.2 Hardware and Software Environment

Acceptance testing of the ECS Release B occurs at the following operational sites: System Monitoring and Coordination Center (SMC), GSFC, and the EOS Operations Center (EOC), GSFC.

The following are Distributed Active Archive Centers (DAACs):

Alaska SAR Facility (ASF), Fairbanks, AK

EROS Data Center (EDC), Sioux Fall, SD

Goddard Space Flight Center (GSFC), Greenbelt, MD

Jet Propulsion Laboratory (JPL), Pasadena, CA

Langley Research Center (LaRC), Hampton, VA

Marshall Space Flight Center (MSFC), Huntsville, AL

National Snow and Ice Data Center (NSIDC), Boulder, CO

Oak Ridge National Laboratory (ORNL), Oak Ridge, TN

The hardware/software configurations are DAAC-specific. The hardware configuration is detailed in the ATPR.

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